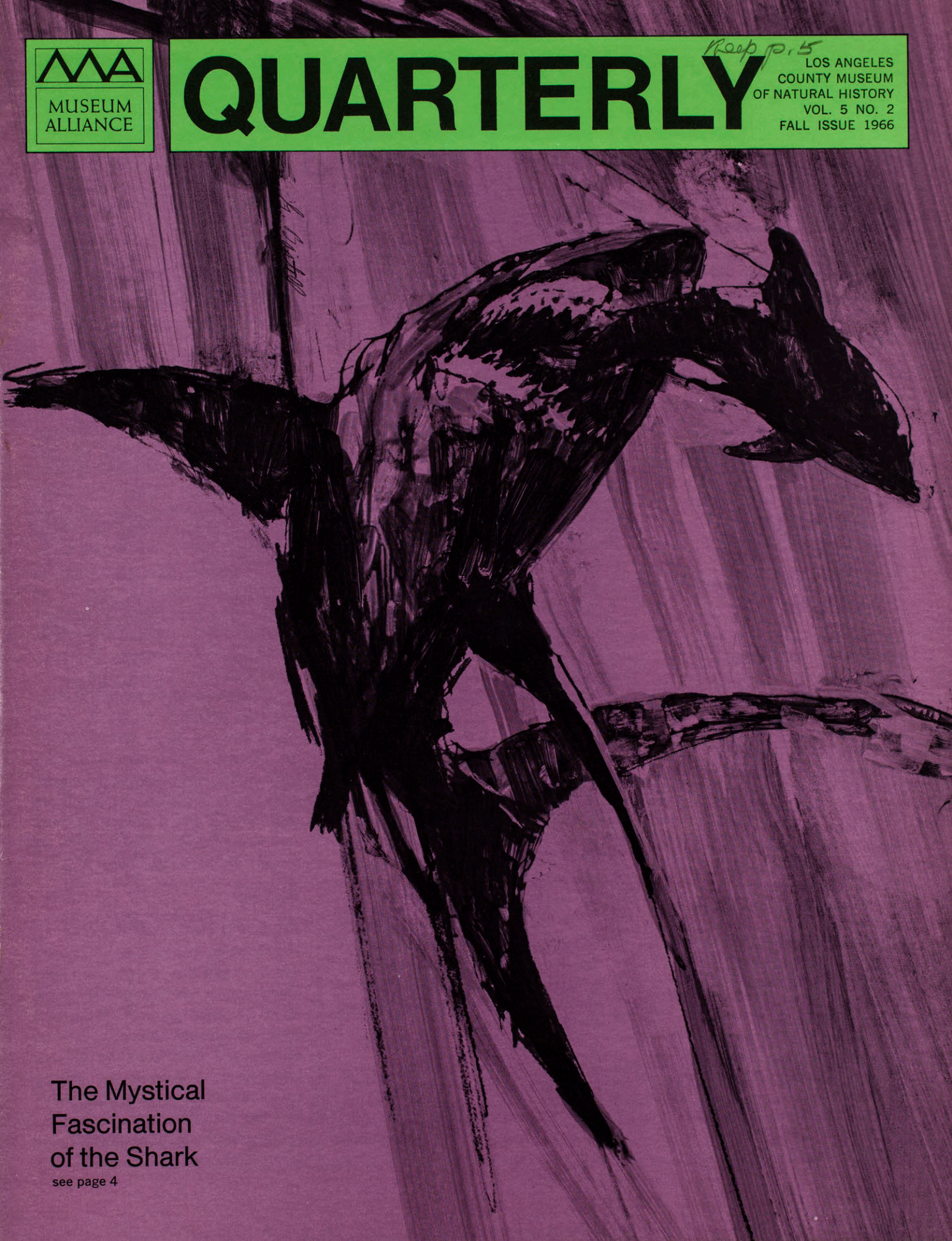
MUSEUM ALLIANCE

QUARTERLY

LOS ANGELES COUNTY MUSEUM OF NATURAL HISTORY
VOL. 5 NO. 2
FALL ISSUE 1966

Keep p. 5



The Mystical Fascination of the Shark

see page 4

MUSEUM ALLIANCE

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SUMMER SALLIES INTO SCIENCE

Once again the **Summer Sallies into Science** program — presented for members' children every summer — has been a huge success.

Under the capable and enthusiastic direction of Mrs. Wynn Hammer and her hard-working staff of volunteers, 3 classes were offered: "From Small Beginnings" for the 4-to-6-year-olds; "Our Puddles Grow" for the 6-to-8 group; and "To the Sky and Beyond" for the 9-to-13-year-olds. Ninety-four children were registered, and many more had to be turned away for lack of room.

An additional feature, new this year, was a series of **Flying Carpet Tours** for mothers. Designed to enrich parents' knowledge of the Museum and to help them make the best use of Museum facilities in working with their children, this series also was oversubscribed . . . and thoroughly enjoyed by the participants.

Did the children have fun while they learned? Well, they kept coming! Unheard-of in a summer program, there were no dropouts, and virtually no absentees! And, for additional proof, see the pictures!

UNEXPECTED CALLER...

A tarantula (carried casually in a coffee can!) caused quite a stir in our "From Small Beginnings" class.

This group of 4-to-6-year-olds had enjoyed three sessions of studying insects and "bugs," learning to understand and make friends with the small-sized life around us, before learning to fear it.

As the high spot of the course, the children were asked to bring a "pet bug" to the final class. Caterpillars, grasshoppers and other harmless critters arrived, as expected. The tarantula was definitely a surprise!

Understandably, none of the mothers were willing to handle it, and it was a pleasure to be able to call on Dr. Truxal for assistance. He not only took charge, telling the class a good deal about this type of animal, but also showed the delighted children how to approach it, what precautions to take, and even how to feed it!

NEW ALLIANCE OFFICE

The Museum Alliance is now in its new quarters, off the Mineral Rotunda. The attractive new location, facing the Rose Gardens, features a custom-designed streamlined arrangement of storage and work-space for greater efficiency; and a small but inviting reception corner awaits visitors. Members and their guests are cordially invited to stop in, admire the office and make acquaintance of the staff.

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GRANDPAS
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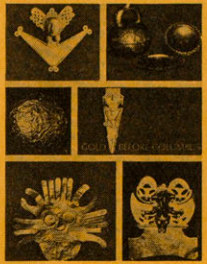

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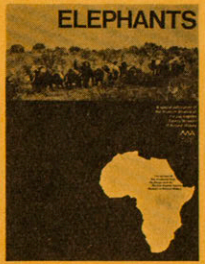

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The journey of 5 elephants from the Kenya bush to the Los Angeles County Museum of Natural History, and, incidentally, all about elephants.

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QUARTERLY

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The Mystical Fascination of the shark

Why we study them

by **Shelton P. Applegate**
Associate Curator in
Vertebrate Paleontology
and
Anita E. Daugherty
Volunteer Worker

Dr. Frank Talbot of the Australian Museum and I stood on the warm beach and bargained with the Moslem fishermen for sharks and rays as they were being hauled from the beautiful hand-carved outriggers run ashore on the clean white coral sands of the palm-fringed beach just north of Dar-es-Salaam in East Africa.

In contrast, Dick Bishop recently broke into a large grin at the thrill of recognition of the faint shape of a 225 million-year-old shark tooth still encased in the purple shale of the cold, treeless, wind-battered slope 8,500 feet above sea level in the Cottonwood Mountains just west of Death Valley. These events, separated by time and half the world, represent two extremes in the program being undertaken at the Los Angeles County Museum of Natural History.

Why should we study sharks? Perhaps the main interest in them stems from the fact that they occasionally attack man. These attacks have been and are being documented by the Shark Research Panel of the American Institute of Biological Sciences. A summary of their studies has been published in the book, "Sharks and Survival," edited by Perry Gilbert. The idea of a shark attack fills most people with horror. If the record of attacks is taken as a whole, however, even in reputedly shark-infested waters, the danger is less than travelling on a freeway. Of approximately 230 species of sharks only a small percentage can or will attack man. Off Los Angeles, of the 23 recorded species, only the great white shark poses a real danger. Blue sharks, which are common, seem generally to be harmless, but as with many sharks, active feeding can cause what is known as a feeding frenzy, in which case the sharks will bite almost anything that

Collecting fossil shark teeth and other marine vertebrates at El Toro, California. These Miocene marine deposits are continually producing new materials for the Museum's collections.

moves, even their fellows. The only other possibly dangerous sharks off Los Angeles are the grey sharks, which only move into our area in the summer and are not common even then; hammerheads, which are likewise not common; and the rare tiger shark which might wander this far north. We are just beginning to learn about shark behavior, and much of what we have found out so far is contradictory. The one certain fact is that sharks are very unpredictable animals.

Ever since man first encountered the shark, this fish has held an almost mystical fascination for him. This was expressed in the tales and myths of seafaring peoples throughout the world. According to the great Swedish naturalist, Linnaeus, Jonah was swallowed by a great white shark. The Hawaiians, perhaps the greatest sailors the world has known, not only told many tales about sharks but worshipped them as gods. It is really not very difficult to see how one might arrive at this conclusion, for a large tiger shark slowly moving into view with his school of pilot fish and shark-suckers has a certain godlike quality. This interpretation may also come from the fact that the shark is so perfectly at home in the ocean, which is understandable since sharks in one form or another have lived in the ocean for over 300 million years. The oldest shark teeth come from rocks that were ocean bottom about 325 million years ago, in what is now central Ohio.

Most sharks are good to eat, and represent a food source that is for the most part untapped. The Japanese have many fine dishes made from sharks and rays, as do the Italians, and the best sort of "fish and chips" that one can get in London utilizes the English dogfish (in reality a cat shark). In some of the markets around Los Angeles it is possible to buy soupfin shark, whose excellent meat goes under the trade name of "greyfish"; bonito, thresher, and several other varieties of shark are also sometimes available. The bonito shark, or mako, is often compared favorably with swordfish. The taste of shark varies with the cooking, and also with the variety of shark. Some, as the swell shark, are quite unpalatable; the blue shark is also unappetizing. The shark gourmet must not only be well read but willing to experiment.

It is a surprise to find that sharks make excellent experimental animals from the medical point of view. They have solved biochemical problems in ways at times quite different from other fishes and from the land vertebrates. These differences help us in two ways. First, they show that there

Screening for shark teeth and other small teeth and bones at the El Toro site.

are other and often simpler methods of controlling and regulating body functions besides those found in the higher vertebrates; perhaps if we can understand how these work in the shark we can apply this information to man. Second, since sharks contain a number of different chemical compounds, an exploration of these and their functions may lead to knowledge of substances that would be extremely valuable to mankind. Sharks seem to have an excellent ability to heal wounds with a minimum of infection. Diseases, particularly those of a viral nature, which affect most other fishes are difficult to discover in sharks. They have a unique antibody system, lacking some of the components found in other animals, yet a system that is evidently very effective. The awareness of the medical importance of sharks was made very clear at the meeting held in Bimini last February on the recent advances in their biology, where a number of medical doctors gave papers on shark physiology and biochemistry. The general consensus was that sharks offered many possibilities in medical research.

Sharks, rays, and chimeras separated from the main fish line at a very early date. The chimeras shortly formed a separate line, while rays were derived subsequently from a group of very primitive sharks. These all show a number of characters that are rare or absent in the other fishes. One such character is internal fertilization. Male sharks, rays, and chimeras have long appendages called claspers in the pelvic fins, which aid in impregnating the females. Chimeras and primitive sharks and rays lay eggs in horny cases, while in the more advanced sharks and rays the young are born alive. In the grey sharks, the embryo is attached by a cord to the wall of the uterus, a condition quite similar to what we find in the higher mammals.

As scientists we must be continually curious, and if we did not constantly ask questions we would accomplish little. This curiosity has been responsible for some studies carried on by us at the U.C.L.A. Bone Research Laboratory, in collaboration with Dr. Marshall Urist, a Museum Research Associate. Sharks and rays today lack true bone cells, yet our recent studies have shown that the mineral, apatite, that occurs in bone occurs also in these animals. This suggests what has recently been speculated upon by Rainer Zangerl, of Chicago, that the original sharks had true bone but their descendants have lost

Shelton P. Applegate, Associate Curator of Vertebrate Paleontology with newly caught Angel Shark. Los Angeles

Times photo.

it. From this it would seem that the so-called calcified cartilage of sharks is not primitive but is a secondary advance. Under Dr. Urist's guidance, we have taken an interest in blood chemistry, since we know that the calcium and phosphate in modern shark hard parts come from the blood. By injecting fluorescent tracers into the blood, we can tell which parts are being actively calcified, for alizarin or terramycin will bind itself only to newly forming apatite. From this work we hope to get information as to whether the rings we see in shark vertebrae are really growth rings.

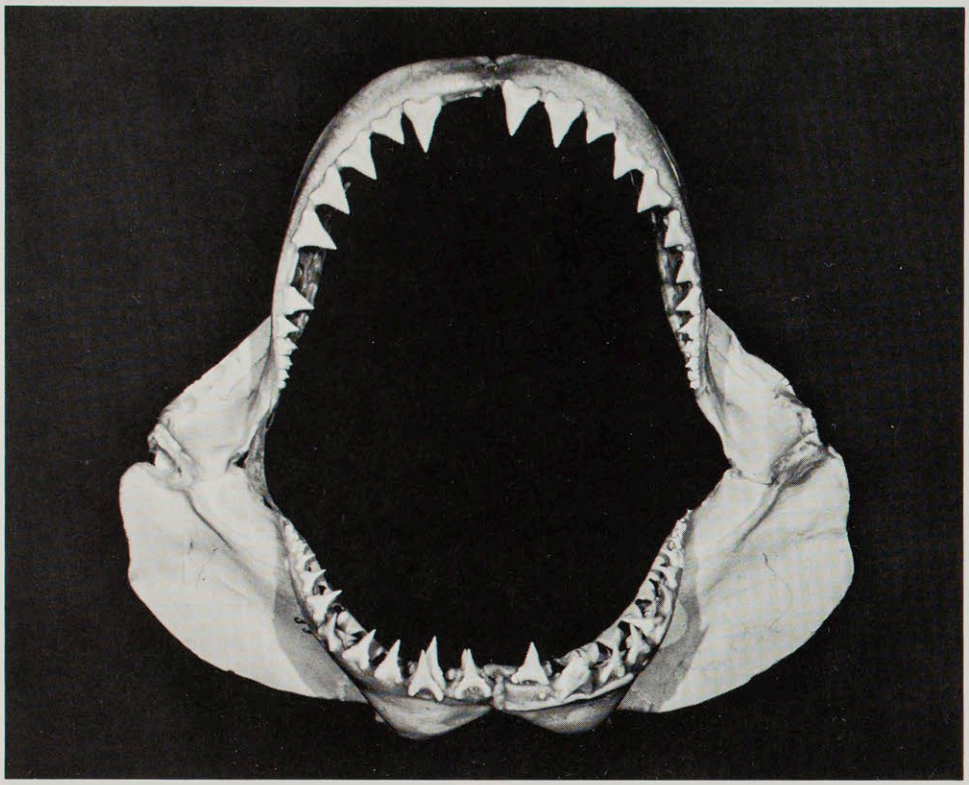
To a student of lower vertebrate paleontology, sharks form excellent subjects. Throughout their lives, sharks and rays are continually growing, using, and shedding teeth, and a single jaw may contain a number of rows of teeth. By marking teeth with the antibiotic terramycin, that becomes banded to the newly formed bone mineral, we were able to show that the horn shark replaced a complete row of teeth every 3 or 4 weeks. With such a continued loss of teeth, and considering that a shark may live 20 or 30 years, it is not surprising that ocean bottoms should receive shark teeth in abundance and that they are the most commonly found vertebrate marine fossils. Currents may cause teeth to be accumulated in abundance, along with other remains. What better example of this could we give than Sharktooth Hill, where the ocean bottom muds and silts have been uplifted through faulting and folding so that we can take a shovel and dig shark teeth out of the hillside in the middle of the San Joaquin Valley?

Since southern California, particularly the counties of Kern, Orange, and Los Angeles, have some of the richest marine vertebrate deposits to be found anywhere in the world, our Museum is ideally located for such studies. The proximity of the Museum to the ocean is also fortunate, for securing live or dead Recent material.

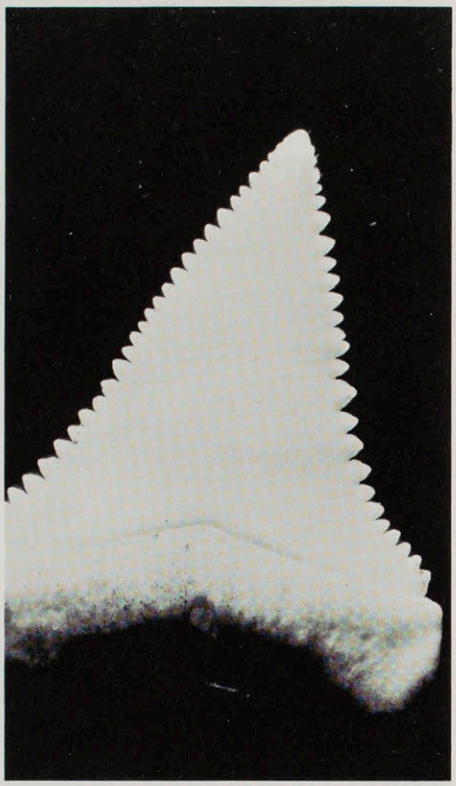
It must be realized that Recent sharks form only a small part of our program; our main concern at present is the fossil record. But to know fossil sharks, one must know Recent sharks. Many experts on Recent sharks have claimed that it is impossible to distinguish Recent or fossil species from their teeth alone, a claim that in some instances may be true but in the majority of cases just isn't so. It is true, however, that teeth may change shape as a shark grows older and that there are sexual differences. Most striking are the differences in teeth from various parts of the jaw. Many so-called species of fossil sharks merely represent teeth from different parts of the jaws of the same shark. To help solve these problems, we are attempting to build up a large collection of jaws from Recent sharks and rays, properly identified and with supporting data. Starting in 1963 with 2 shark jaws and no data, we now have a collection of 415 shark and ray jaws of 85 species. (This includes 137 specimens of 45 species recently received from the California Department of Fish and Game, most of them prepared by the junior author.) Of the 415 jaws, 305 specimens are of sharks, of 58 species, which is about one fourth of the known living sharks of the world. Each jaw requires a great deal of work, and a slip of the hand may result in a nasty cut and even possibly an infection.

Once we know the range of variation of teeth in a Recent species, we

Jaws of the Great White Shark. This is the so-called "Man-eating" shark.



An isolated tooth of the Great White Shark.

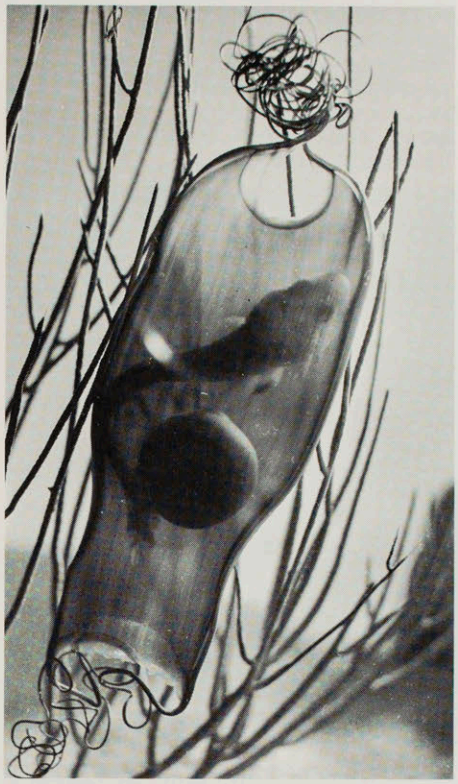


can select teeth from its fossil relatives of which we have large series and try to arrange them in complete sets. It has been possible, for example, to make up such composite or synthetic sets from teeth found at the Rossmore Company's Leisure World, El Toro, in Orange County. Here, an employee found and collected a pocket of shark teeth, which marked the discovery of one of the most important marine fossil localities in southern California. Through the efforts of Earl Calhoun, an employee of the project, Museum workers were invited to collect on the site. Excavating this deposit involved sieving all the material, a method which produced hundreds of teeth.

From other localities, such as Sharktooth Hill and Pyramid Hill, in Kern County, we have brought back bags of soil and likewise worked it through screens, thus obtaining even the tiniest shark and ray teeth, many belonging to kinds which would otherwise be rarely seen or missed entirely. Many have been given us by Dick Bishop, a Museum Field Assistant living in Kern County, who has been a great aid to our program. He started collecting fossil shark teeth as a hobby, and has developed an unusual knowledge of the Californian record. He and the senior author have collected some of the oldest teeth to be found in California, and are in the process of writing up a large fish and shark fauna from Pyramid Hill.

How do we get Recent shark specimens? Many, we go out and fish for ourselves. There are many ways to catch sharks. First, we may use nets. Large-mouthed shrimp, trawls sweeping the bottom often bring up small sharks alive, and on the "Anton Bruun" cruise 9 in the Indian Ocean we caught a number of cat sharks in this way. Gill nets may be the most effective way of catching medium sized to large sharks. We have had the privilege of working with one of the masters in the art of setting gill nets, Gene Hachez, who is one of the few current shark fishermen in California, working out of Newport Beach. Each fishing day he sets 4 nets in the submarine canyons off southern California, fishing chiefly for soupfin. The holes in the nets are comparatively large, but they are sure-fire shark catchers. All a shark has to do is swim into a net; the instant it feels the net on the side of its head it will turn and roll, thus getting rolled into the net, from which it can seldom escape.

Mermaid's Purse. The embryo of a Swell Shark in its egg case. The round yolk is the food supply for the developing embryo. Courtesy of Marineland of the Pacific.



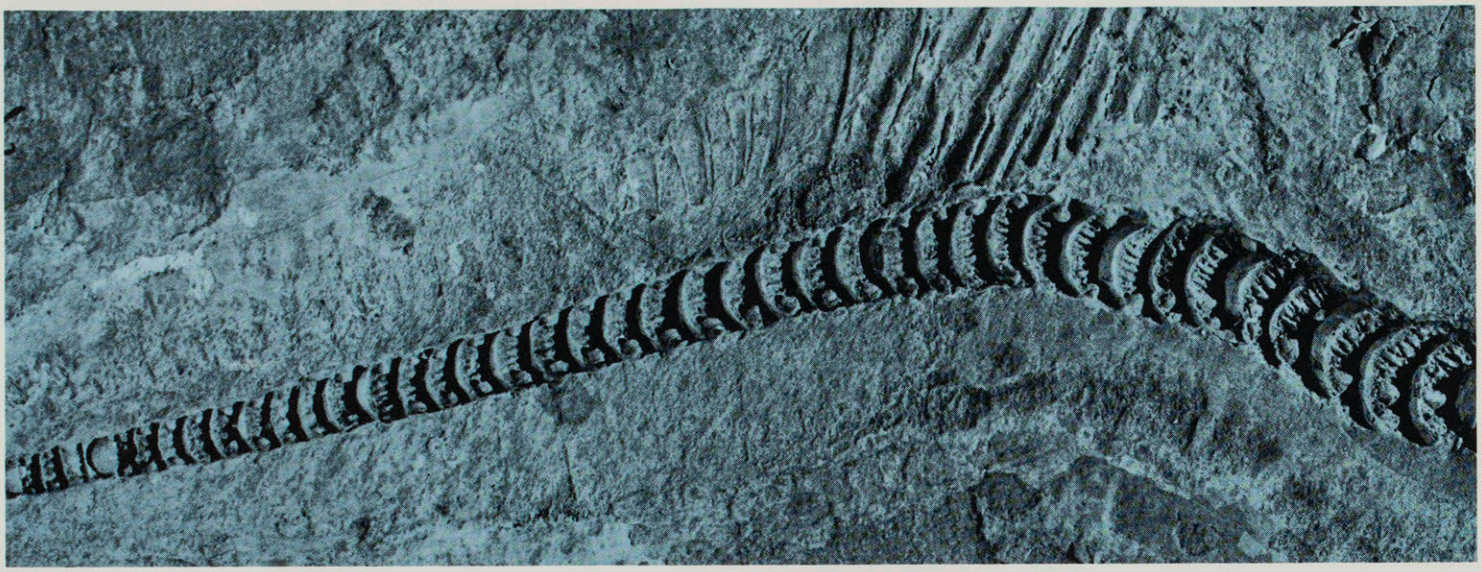
Some sharks are caught in lobster traps, and with the aid of Mr. Sheen, a friend of the Museum, and his boat we set such traps off Catalina Island, and in 4 traps caught 50 swell sharks. Some sharks can be harpooned, particularly blue sharks, hammerheads, and rays, and we have used this method very effectively. One of the best harpooners I know is Clint Walker, the movie actor, who is a strong supporter of our work.

Of all the methods of catching sharks, the most exciting, to my mind, is long line fishing, the technique used by Japanese fishermen for tuna and other large fishes. We set a line about 2 miles long from the stern of a boat. Every 90 feet or so is a dropper line with a 6 foot or more steel leader ending in a baited 3-inch Japanese tuna hook; though small, this hook is quite effective in catching as large a shark as one could wish for. Every 11 hooks there is a float, usually an inner tube. At each end of the entire line there is a buoy and flag. The gear is left down for two hours, which usually seems to be long enough. In one such set off Catalina Island, with 100 hooks, we caught 97 sharks. Since we were in a 28 foot cabin cruiser belonging to Robert Lynch, of the Museum Alliance, we almost filled the boat with sharks.

A new technique for fishing long line gear has been developed by Carl Hubbs and Al Shover, of Scripps Institute; this technique we used in the Indian Ocean and plan to use off southern California. This is deep-set long line fishing involving the use of magnesium links which attach the line to weights, for which purpose cinder or cement blocks are suitable and inexpensive. The line sinks to the bottom in a spread position. After about 8 to 12 hours, the magnesium corrodes to the point where it drops the weights, and the line is buoyed to the surface by floats filled with gasoline, a liquid that can withstand the great pressures that occur in the depths fished but is much lighter than water. Using this gear, we caught 13 deep sea spiny dogfish at a depth of 400 fathoms (2,400 feet) in the Indian Ocean.

Every shark collected is measured; sex is also recorded, as is locality, depth of water, and any unusual features. We encourage people who collect for us to likewise furnish this data. This includes sharks taken for jaws or for preserved specimens, ones from blood samples and other mate-

Fossil shark tail from the Palos Verde Peninsula. The skeletons of sharks are rare items in the fossil record due to the general lack of ossification of the bones. Usually teeth are the only available record.



rials are taken, and ones taken alive to be kept in holding tanks. It also includes animals which are tagged and released. The American Institute of Biological Sciences sponsors a program of tagging sharks and rays, in the hope that they will be recovered, and thus give us information about their movements, age, and growth. This program is being run by Stewart Springer, a Museum Research Associate and one of the two leading American authorities on Recent sharks.

The California Department of Fish and Game has donated whole specimens collected by commercial net fishermen or taken on their own boats, and have helped with gear. Marineland of the Pacific has provided holding facilities and helped with gear. Gene Hachez, already mentioned, has contributed such rare specimens as the big-eyed thresher and the bramble shark. Warren Beadle, another commercial fisherman, has sacrificed space on his boat to bring back sharks for us. Tim Doheney and Vernon Barrett, longtime friends of the Museum, have helped us catch and tag blue sharks. Many other fishermen and sportsmen could be mentioned who have assisted us freely, as have fish markets.

What are the ultimate aims of the shark program at the Museum? They are: first, to gain knowledge of sharks and rays, but second and more important, to spread that knowledge to the people of Los Angeles County. This is a goal that we hope to accomplish by publishing reports and papers on our work through the Museum and other organizations; by maintaining collections with free access for all who are or may become interested in fossil and Recent sharks; and finally, and perhaps most important, by creating exhibits which will tell the story of sharks. An example of such an exhibit is one that will be seen in the fossil marine vertebrate hall nearing completion, which will show teeth of fossil and Recent sharks, including for the first time synthetic sets of teeth from southern California localities.

What is the future of the program? Our main hope is growth both in collections and in the interest of the public. We need to be able to go to as many as possible fossil localities, both in Southern California and in other parts of the world. We need equipment and means and time to collect Recent sharks and rays. If you have a real interest in our friends the sharks, come down and see what we are doing and perhaps you may assist us in our program.

MUSEUM BOOK STORE

The Museum Book Store now has a large variety of Reproduction Artifacts copied from the Museum of Anthropology in Mexico City.

These pieces are made by the Museum and the University of Mexico.

Without the stamp of the Museum, no one could tell the difference from the original without thoughtful examination.

The clay for each piece comes from the same area where the original was made and the Museum and University have attempted to reproduce the exact firing process as was used in each of the originals.

The Colima musician pictured here is a fine example of the ceramic work in the Classic period 100 to 600 AD.

The artists seem to have been keen observers and show a sense of humor in their artifacts.

The Museum Book store has dozens of reproductions of artifacts from the various cultures of Mexico. They are priced from $1.50 to $60.00.

Colima Musician... the ceramic figure 33 cm. high $20.00 ppd.

Members of the Museum Alliance are entitled to a 10% discount off list price $18.00

Please send your check or money order to The Museum Book Store at The Los Angeles County Museum of Natural History Exposition Park Los Angeles

by **J. R. Macdonald**
Senior Curator of
Vertebrate
Paleontology

Dig that Horse Heaven...

Floyd Humeston, Mary Odano, Elves, and Elflettes are working on the colt skeleton. Steve Odano is screening sand in search of mouse jaws and other goodies.

Bulldozing a floor and side wall for the quarry.

Anybody with a knowledge of the geography of the northwestern United States knows that the Horseheaven Hills are in southeastern Washington in the bight of the Columbia River. But, if you have ever been on top of the bluffs on the west side of the Snake River, opposite Hagerman, Idaho, you know that that must have been the place where "the horses went to die." Actually, we know that the old fable of the place where the elephants go to die, or the this's or that's go to die is just that, a fable. It does happen that just across the Snake River from Hagerman, Idaho, there is a great deposit of three and a half million year old, late Pliocene horses.

Those horses are actually zebras. We don't know whether they had spots, stripes, polka dots, or were gingham checked. We do know that they had zebra-like teeth. The quarry was found in the late 1920's by a local resident, Elmer Cook. Mr. Cook sent specimens to the Smithsonian Institution and in the late 20's and early 30's four field parties from the Smithsonian spent their summers at Hagerman, and collected a great number of horse remains and other fossils. A hundred and thirty skulls and about fifteen skeletons were collected by these parties. Since that time, other museum parties have visited the locality briefly, and collected horse skulls and the parts of other animals.

It has been a long-standing ambition to reopen the quarry in order to get a representative collection for the museum for which I was working. With the museum's work in the Anza-Borrego Desert, and with the Ringold fauna from near Hanford, Washington, (the latter work resulting from the cooperation of Mr. William Shawver of Kennewick, Washington, and the generosity of Mr. George F. Beck of Yakima, Washington . . . see "A Gift of Old Bones," The Museum **Quarterly**, Summer 1966), a Hagerman collection became a "must." This year we were able to spend June working the quarry. The basic **we** was Floyd Hume-ston, Preparator in Vertebrate Paleontology, and the writer. We were variously assisted by a group from the Museum of the University of Michigan, under the direction of Dr. Claude W. Hibbard, and Mrs. Mary Odano and her three elves and two elvettes. This might take a little explanation. Mary has been a volunteer worker and then a part-time worker in Vertebrate Paleontology for several years. She has recently become a full-time Preparator to replace Michael Hammer for two years while he is serving with the Army. Mary's three elves are her son Steve, and two other teenaged boys, Mike Gray and Fred Chasson. The elvettes are twelve and thirteen year old Jan and Allyn Odano. Steve, Mike and Fred have spent most of their Saturdays during the past year helping Mary prepare the **Pliomastodon** which they helped collect from near Beaumont, California in 1965. You will find pictures of that operation in "Fossils are for Digging," which appeared in the Spring, 1966 **Quarterly.**

It is generally good practice to begin a story at the beginning, so perhaps we should drop back three and a half million years, in order to examine southwestern Idaho at that time, and find out how it happens that such a large number of horse remains should be found in such a small area. First of all, why do I insist on this deposit's being 3,500,000 years old? There happens to be a lava flow about a hundred feet below the level of the horse quarry. The Potassium-Argon dating of this flow gives it an age of 3,500,000 years. Above and below this flow are volcanic ash beds with slightly younger and slightly older dates. There are about 500 feet of sediments exposed between the surface of the Snake River and the top of the bluffs, just a few feet above the horse quarry level. The fossil fauna of these beds indicates that a relatively short piece of geologic time is represented by these deposits, possibly two to five hundred thousands years or, geologically speaking, a mere tick of the clock. Hence, 3,500,000 years is a good average age for the deposit.

Today, the Snake River goes through this area in a canyon which at this point broadens eastward to form the Hagerman Valley. On the west are the sedimentary rocks of the Glenns Ferry formation, and on the east, the lavas of the Snake River Plains. When these beds were being deposited, sediments were being carried by a well-watered drainage system from newly forming mountains to the south and to the west. In those days, southwestern Idaho was not a desert, but probably a rather lush savannah or long-grass prairie with scattered trees. While these sediments were being carried into this basin from the south and the west, nearly continuous volcanic eruptions of fluid, thin, almost water-like basaltic lavas were pouring out over what is now the Snake River Plain. I can visualize these lavas flowing westward, trapped between the mountains on the south and the north, until they ran into the base of the long apron of sediments from the south and west. The miles-long battlefront where the waterborne sediments and the molten lavas collided must have been an awe-inspiring spectacle. This is essentially the place where we were digging. The present Snake River in the Hagerman Valley marks the boundary between these two geologic settings. We find very few flows crossing the present course of the river, and relatively few sedimentary deposits on the other side. Of course the lavas weren't being deposited all the time. However, the lavas did form a dam to stop the sediments, and the streams lakes and swamps at the bottom of the sedimentary apron blocked the westward flow of the lavas. The resinate drain-

age in those days probably wandered along to the northwest, much as the Snake does today.

At the junction of the sediments and the lavas, there were a large number of small and medium-sized lakes, swamps and wandering streams. Some of the streams were dammed by beavers. We find the remains of these old beaver ponds represented by six to eight inch strata of extremely carbonaceous clay, indicating the accumulation of vegetable material on the bottoms of the ponds. The fossil beaver, **Castor californicus**, is a common form found throughout the entire range of the formation.

There were many animals inhabiting this plain. When you think of the conditions at that time, think of the wonderful pictures you saw twenty or thirty years ago of the vast herds of African animals. Such was the situation here in North America in the Pliocene. It seems that the Hagerman area was a favorite haunt of the horse, **Plesippus shoshonensis.** As with any large population (and perhaps at times the horse herds numbered in the thousands), there were many deaths each year. Death came to horses of all ages, from new-born colts to ancient grey manes. It would be natural for many of these deaths to occur near the waterhole. Here the herds would be assembled much of the time, here perhaps the sick and the weak would remain, and here the carnivores would come for supper. Some were trapped in bogs and the skeletons remained articulated. Most died within or along the stream's boundaries, and the skeletons became scattered during the dry seasons and were later swept up and piled in sandbars like jackstraws with the coming of the rains. Thus a tremendous accumulation of skeletal material was deposited through a relatively short period of time in this locality.

Jumping ahead into the more recent past, we find that the Snake River, fed by melting glacial water from the Jackson Hole area and from the runoff of ancient Lake Bonneville (which formerly covered the area now occupied by the Great Salt Lake and the surrounding lowlands), cut itself a deep canyon through much of southern Idaho. It widened at this point to form the Hagerman Valley on the east and the bluffs in which we were digging on the west.

Now let's return to the present and the fulfillment of an ambition. Floyd Humeston and I left the museum on the first of June and established our camp on the edge of the Snake River, just across from the famous and beautiful falls of 1000 Springs.

Operations began on the third of June. Through the kindness and cooperation of the commissioners of the Buhl Highway District, we were able to use a bulldozer to remove overburden and bench the quarry face. A day's work with the dozer cut down the quarry face and top to the point where we no longer dared use this method. From then on, it had to be hand work. For the first week, we spent most of each day swinging a shovel. Actually, the quarry material is quite nice to work: a kind of coarse grained sand, with just enough clay to make it stand in cliffs when slightly damp. There are masses of cemented material, but most of the rock can be removed with a whiskbroom when you are working near a fossil. At any rate, there were quite a few days of idiot-stick swinging, with each of us moving his ten to fifteen tons of sand per day. Now this isn't just a matter of picking it up in one place and laying it down somewhere else. Check with any old excavator, that is, any old excavator of fossil or archaeological sites, and you will find that the trick is to throw the dirt as far as you can, or later you will have to move it again. and again, and again. Our dirt was moved, and all of a sudden we started finding fossils.

We averaged a horse skull or cranium a day. Most of these were found in a single trench six feet wide, extending about twelve feet back into the face of the bluff. Here skulls, jaws and other skeletal parts were jumbled together in an ancient sandbar like giant jackstraws. Some were in very hard concretions, some in soft sand, but all had to be carefully handled and untangled. Each bone had to be removed in a proper sequence in order to preserve as much of the bone as possible. The digging continued throughout the month of June. Actually, Floyd and I felt, by the middle of the month, that we had "paid for the trip." This is an old fossil digger's expression for the moment when the field trip would be a success even if you didn't find another scrap of bone for the duration.

In spite of our early success, we kept the pressure on, right up to the end of the month, aided by our many friends who jumped in and dug with a will.

The result of the dig was about twenty-five horse skulls or crania; a colt skeleton which will make an excellent companion piece to the mounted adult skeleton we already have from a trade with the Smithsonian, a great pile of miscellaneous horse skeletal material; a remarkably complete cormorant skeleton, and many parts and pieces of other animals from the fauna.

On two days when weather conditions did not permit collecting at the quarry site, we visited a nearby lake bed locality of the same age, and found about a dozen fish skulls 6 to 8 inches long, plus a great deal of other fish material.

We won't dwell on the cold start of the month, its hot ending, or on the constantly blowing sand which filled our eyes and noses and often the hole we were digging just as fast as it was dug. These things go with fossil collecting. But we will admit that we are mighty proud of our collection and we believe it is a great addition to the museum.

Nature's Perfect Package

by Ed N. Harrison

Color plate preceding page: individual variations in coloration of eggs of the California Murre.

Individual variations in markings of eggs of the Bullock's oriole.

All birds lay eggs and all birds come from eggs. The egg is merely one stage in the life of a bird; it is not a separate organism in spite of the fact that it seems to have a separate physical existence. This is why the old question, "Which came first, the chicken or the egg?" has no real meaning, and why it seems like an unanswerable query, raised repeatedly in unthinking context.

In this account, when we write of birds' eggs we are really writing only of the egg shells. The shells are essentially nothing more than the containers that hold the developing bird-to-be and the food supply for its growth up to the time of hatching. Simply as containers, they are of interest as one of the strongest, (for their weight) and lightest, and most effectively "leak-proof" of all known natural packaging materials. This is their primary function, but aside from this the egg shells are so varied in size, shape, color, and markings that they have long excited the curiosity and admiration of countless naturalists. Until fairly recently many individuals had their own collections of eggs, carefully prepared, well documented, and adequately housed. Collecting eggs seldom reduces the numbers of the species as the parent birds often start a new set to replace the old one.

There has been a great reduction in the number of egg collections and of the interest taken in them. This is partly because laws protecting our nesting birds have stopped much of the erstwhile collecting, and partly because once the nest and eggs of a particular kind of bird became known there was little need for examining endless numbers of each kind. However, there still are many birds, especially in the tropics, whose nests and eggs have never been found or described and as a result our knowledge of these species is incomplete. Aside from such cases, there still is much

that may be learned from egg collections, even if the major facts they might convey have already been reported. Finding nests and eggs causes naturalists to learn more about the birds than they would otherwise know.

The visitor to an exhibit, not primarily concerned with adding to knowledge other than his own, may find much of interest and pleasure in contemplating eggs for their beauty and for their diversity. The thought is worth keeping in mind that these shapes, colors and patterns are not without significance in the lives of the birds; the appearance of the eggs is the result of adaptive evolution just as much as is the plumage or other parts of the birds themselves.

The eggs of most species of birds are fairly constant in their size, shape, coloration and number, but in some cases there is considerable range of color, which suggests that in those species the need for close agreement with the background, and hence for concealing coloration, is less critical than in others. Thus, some of the sea birds, such as murres, that nest in colonies on seagirt rocky islands where there are few predators, have a remarkable range of egg shell colors, although all the eggs of one bird are alike.

In cases like this, variation may have an adaptive value in itself, in that it may make it easier for the parent, returning after feeding, to identify its own nest and eggs. Some idea of the variety of colors in the eggs of the California murre may be grasped from the plate accompanying this article.

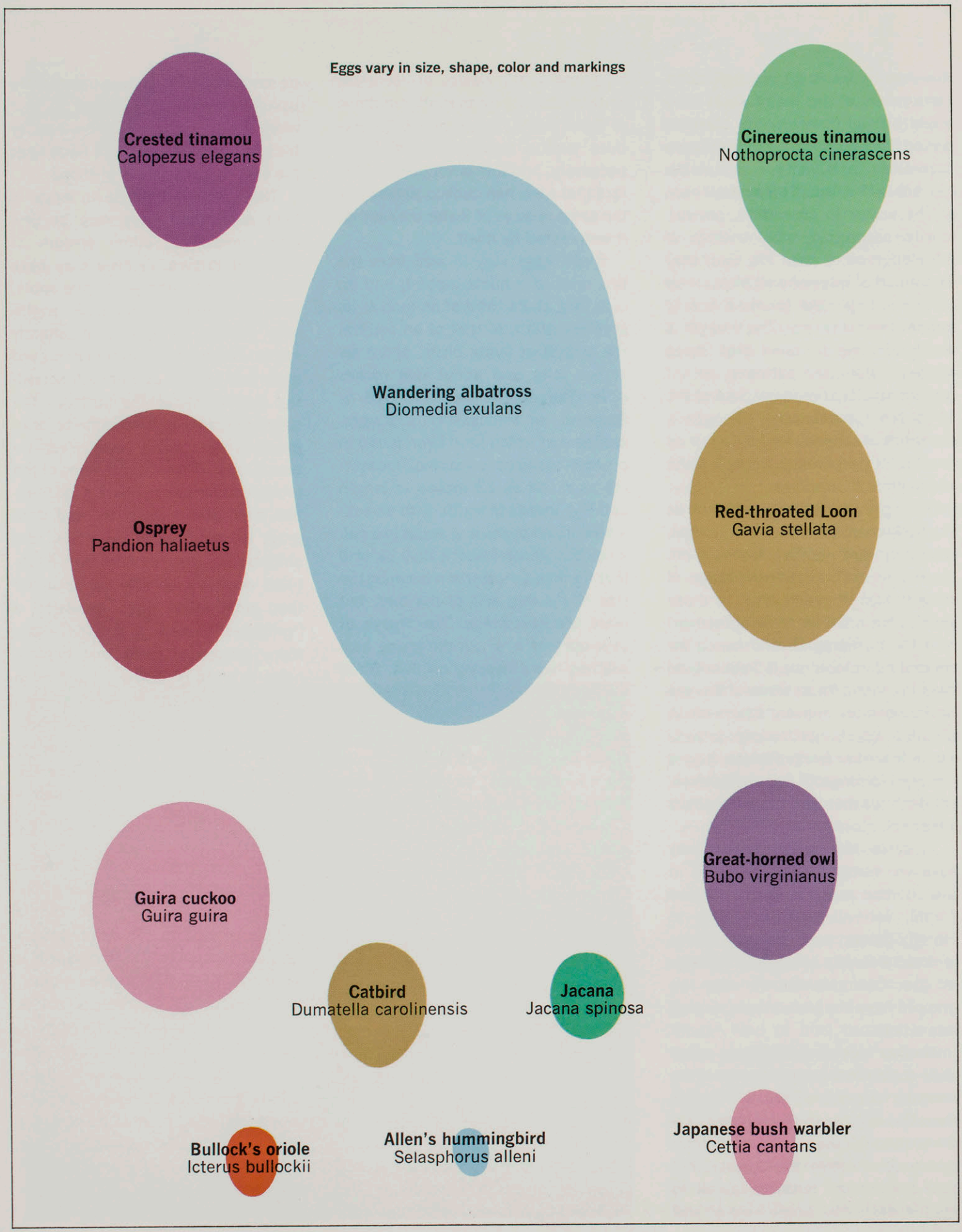
Another type of variability in coloration occurs in the eggs of some of the parasitic cuckoos of the Old World. Here the eggs of each individual are alike, although they vary greatly from bird to bird within the species, but each hen cuckoo tends to lay all its eggs in nests of a single kind of host bird, and in the course of countless generations egg types similar to those of these hosts have evolved. To produce such a result, a continuity is necessary, and this is supplied by the fact that each hen cuckoo parasitizes the same species of foster parent that it was reared by itself.

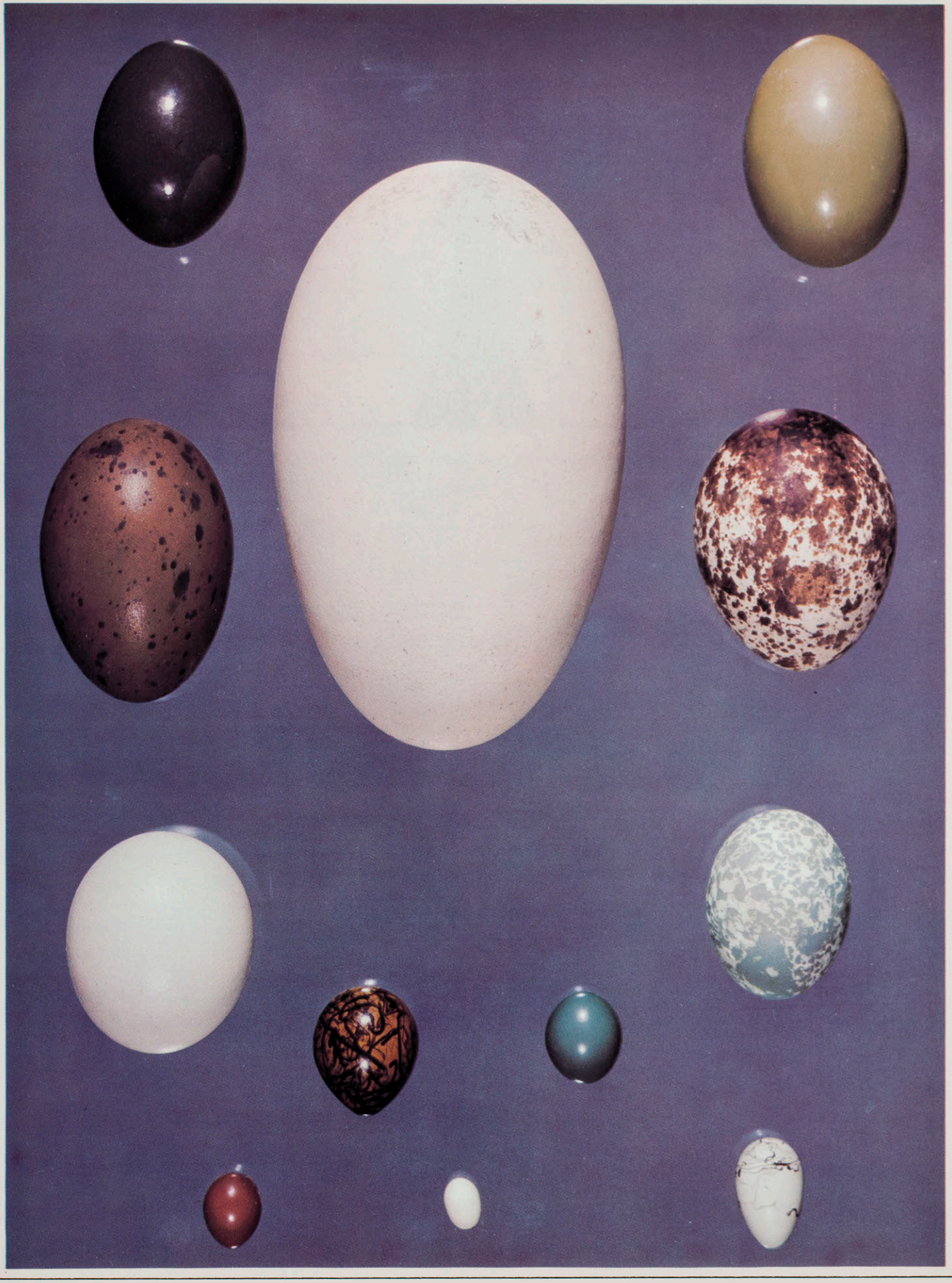
Birds' eggs vary in size from the tiny ones of a hummingbird, half an inch long and a third of an inch at its greatest width, to that of an ostrich, the largest of living birds, about six inches long and about five inches wide. The extinct elephant bird or **Aepyornis** of Madagascar, laid eggs, numbers of which have been found in a semi-fossilized condition, measuring as much as 13 inches in length and 9½ inches in width, with an estimated liquid content of about two gallons. In a general way it may be said that there is a correlation between the size of the egg and of the bird, but there are exceptions. The degree of development at which the young bird hatches has a bearing on this. Birds like sandpipers and quail are fully feathered and have their eyes open when hatched and are able to run about and feed within an hour, while the young of most small song birds are hatched blind, naked and unable to move about. The eggs of the sandpipers are relatively larger for the body size of the bird that laid them than are those of the song birds. They are, in effect, the pre-hatching "homes" of the developing young for a longer time and have to provide more food as well as space to accommodate this extra growth.

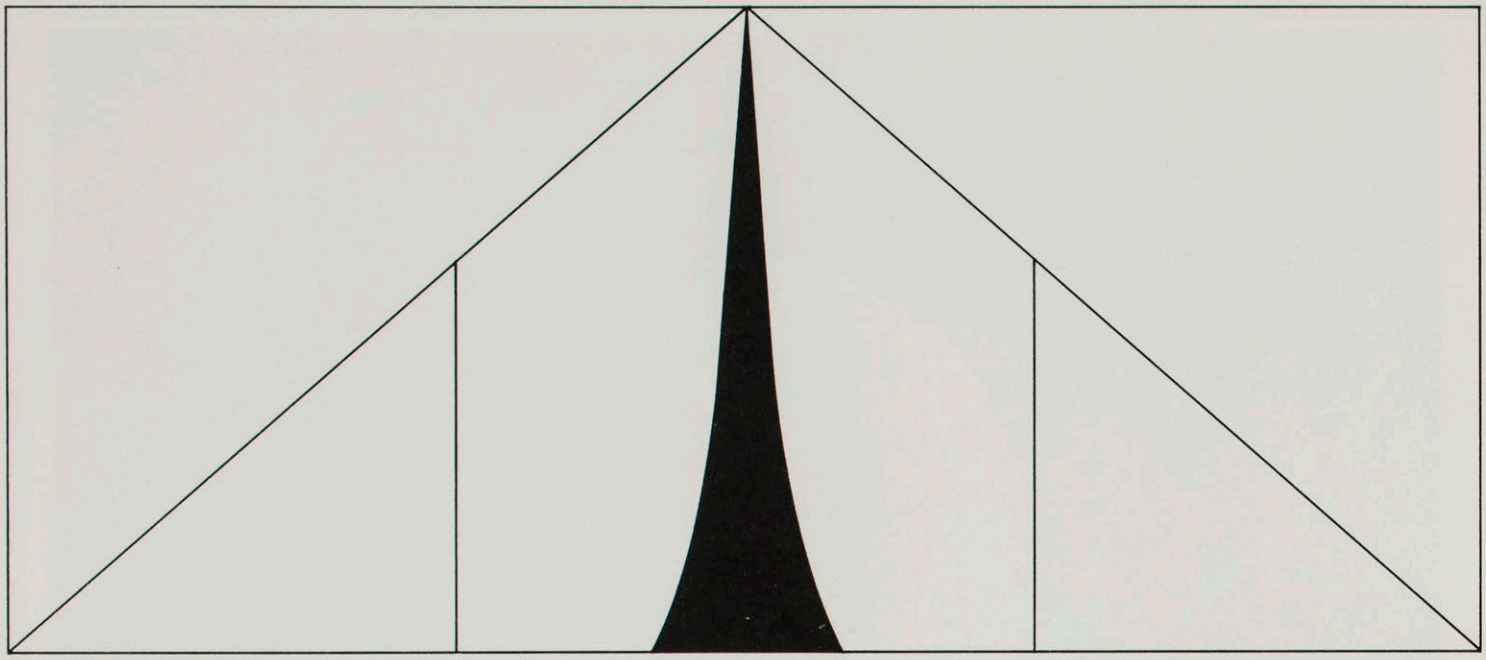
Birds' eggs range in shape from spherical or round, as in many owls, to oblong oval or elliptical, as in sandgrouse and pigeons, to biconical or long subelliptical, as in grebes, to long narrow oval as in swifts. The one thing all have in common is the absence of angles, all contours are rounded. Eggs of sea birds that nest on narrow ledges, such as murres, are usually pointed at one end so that when moved by the wind they tend to turn rather than to roll off. Such eggs are said to be pyriform in shape.

The greatest interest in eggs is their coloration. They may be uniform, unmarked, either smooth or pitted in texture, or they may have several colors arranged in fine spots, in larger irregular blotches, in lengthwise streaks, in transverse, slightly vague, bands, or in irregular curved lines that appear as so much scrawling over much of the surface. The range of colors is from white to blue, green, pink, yellow, buff, reddish-brown, and, in the case of some of the tinamous of tropical America, enamel-like dark green, purplish, and dark gray. Reptiles' eggs are white, and since birds are an offshoot from a reptilian ancestry, it may be assumed that plain white eggs represent a "primitive" condition in birds' eggs. Many groups of birds that nest in holes in trees or in the ground or in other concealed dark places lay unmarked white eggs (owls, woodpeckers, swifts, etc.); most birds that lay in open-topped nests on or near the ground, where concealing coloration is more critical, lay colored, marked eggs.

The number of eggs in one breeding is called a clutch; the size of the clutch is largely dependent on the number of young a pair of adult birds can rear successfully. This, in turn, is related to the available food supply, and to the normal percentage of loss of eggs and young to predators, weather, and accidents. Thus, the appearance and the number of the eggs is in keeping with the exigencies of a constantly altering external world. For all their quiescent appearance, egg shells harbor an inner vitality sheltered from a critically attuned external environment.


Eggs vary in size, shape, color and markings
Crested tinamou
Calopezus elegans
Cinereous tinamou
Nothoprocta cinerascens
Wandering albatross
Diomedia exulans
Osprey
Pandion haliaetus
Red-throated Loon
Gavia stellata
Guira cuckoo
Guira guira
Great-horned owl
Bubo virginianus
Catbird
Dumatella carolinensis
Jacana
Jacana spinosa
Bullock's oriole
Icterus bullockii
Allen's hummingbird
Selasphorus alleni
Japanese bush warbler
Cettia cantans





CAMPERS AND CAMPING

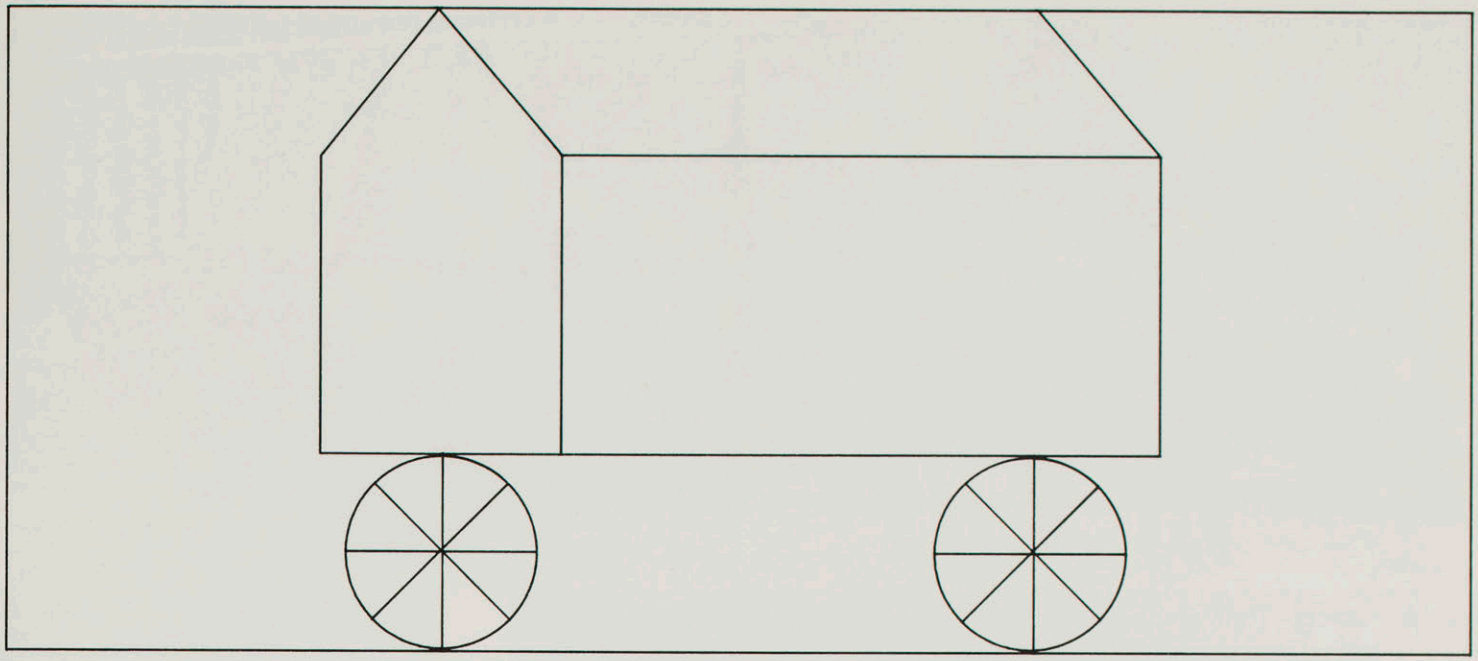
with an accent on El Vagabundo

by **John Dewar**
Associate Curator
History Division

There is perhaps no other spectacle in the American experience which has so continuously excited the young and the old than the sight of a sturdy, boat-like vehicle silhouetted against the evening sky.

Some called it a Conestoga wagon, so-named when the 18th century Dutch settlers in the Conestoga Valley of Pennsylvania cast aside their traditional Palatinate carts and replaced them with a four-wheeled wagon of their own design; others, perhaps a New Englander, homesick for the white-sailed ships of his familiar harbor, might have thought it a "prairie schooner"; but for millions of Americans it was (and is) simply the **covered wagon.** That it has persisted from the time of the Great Migration westward in the 1840's to the present is indicative of its appeal both to the imagination and to its usefulness. The covered wagon survives today not only on the television screen and in the museum, but also on the concrete highway. The fifty-foot, two-bedroom and bath mobile home, the self-contained campers and microbus are not recent phenomena; nor are they simply a reflection of the past. To most of their owners they are a way of life.

The early families that settled in the West were quite aware of the



Camp Life in Antelope Valley, Cal. C.C. Pierce photo.